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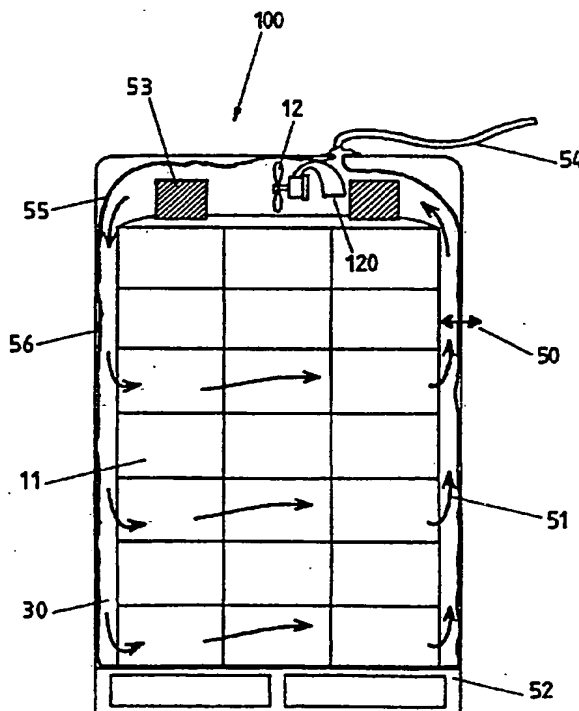
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(54) Title: IMPROVEMENTS IN OR RELATING TO A METHOD OF TRANSPORTING OR STORING PERISHABLE PRODUCE

(57) Abstract

The invention allows cool rooms or sea containers designed for frozen goods to handle produce requiring more precisely controlled temperatures and conditions, e.g. vegetables and fruits requiring temperatures in the chilling range and often also needing control or modification of the atmosphere. Each load of produce (100) (e.g. of pallet size) is held in the sea container or cool room but is sealed from the air of the refrigerated environment by, for example, a plastics bag (56). The atmosphere within the bag is then circulated by a fan (12) (or by convection currents from a heating element) so as to pass through the load and around it via ducts (30) provided adjacent the bag (56). Heat exchange (50) between the circulating gas and the refrigerated environment, via the plastics film, serves to cool the load. However if cooling is excessive a heating element can be used to raise the temperature of the circulating atmosphere. Gas composition of the atmosphere can be controlled by scrubbing, flushing, etc. via pipes from a central unit or at each load individually or by choosing semi-permeable plastic for the sealing bags.



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**"IMPROVEMENTS IN OR RELATING TO A METHOD OF  
TRANSPORTING OR STORING PERISHABLE PRODUCE"**

**TECHNICAL FIELD**

5       The present invention relates to improvements in and/or relating to a method of transporting (or readying for transport) or (readying for storing) storing perishable produce it also relates to apparatus, containers and palletised loads.

**BACKGROUND ART**

Perishable produce is transported by road, sea, rail and air using a variety of  
10 different techniques. With high value perishable produce it has been usual to rely not only upon refrigeration but also or instead the use of a controlled atmosphere that best suits the preservation of the produce.

By controlled atmosphere is meant any infusion, scrubbing or the like of a sealed or controllable atmosphere about the produce and usually involves the control of one or  
15 more of the gases: nitrogen, oxygen, carbon dioxide and ethylene.

By perishable produce is meant any produce the value of which can be maintained or enhanced by slowing senescence (ageing) thereof while being stored, readied for transport and/or being transported. The produce can be a respiring comestible such as a fruit or vegetable, a non-respiring produce such as meat or fish as well as any mixture or  
20 combination of produce made using any of the foregoing with or without other additives. Perishable produce could include within its ambit live fish, shell fish of any form, crustaceans in any form etc.

Perishable produce could also include, flowers, drug body organs or other items requiring a controlled temperature.

25       Transportable container could include pallet based transportable items such as plastics wrapped stacks of produce or cartons of produce.

A feature of current technology is the trend towards the use of refrigerator containers of standard sizes capable of being handled by container handling equipment onto and off of trucks, railway trucks, ships, etc. The present invention however  
30 recognises the possibility of some advantage over customising such containers to provide

-2-

some enhanced control insofar as the atmosphere and/or temperature is concerned which if desired can lend itself to the use of existing refrigerated shipping, cool stores, refrigerated transportation containers or the like thus reducing the level of commitment that might be required to capital expenditure.

- 5 It is therefore an object of the present invention to provide a method of storing, transporting or readying for transport of perishable produce including apparatus applicable thereto which will at least provide the public with a useful choice.

Examples of the prior art include US Patent Specification 5,125,237. This relates to a solid sided insulated pallet sized container which incorporates spaces for forklift, it  
10 includes fans for air circulation. However, this system utilises solid CO<sub>2</sub> for cooling, it does not utilise heat transfer across the walls of the container to possibly cool the interior. No form of sealing the container is disclosed.

US Patent Specification 3,633,381 discloses an open cycle portable refrigerator which uses a compress gas cooling system. It provides a insulated box and the air is  
15 circulated by convection means and not forced. There is no use of heat transfer across the walls of the container to provide for maintenance or alteration of the internal temperature.

#### DISCLOSURE OF INVENTION

In a first aspect the present invention consists in a method of transporting, storing (or readying for transport or storing) perishable produce which comprises;

- 20 (i) loading and sealing the produce into a sealable transportable container or onto a pallet (hereinafter "container") to substantially isolate gas associated with said produce from the surrounding environment, said container or pallet having

means electrically energisable or otherwise actuatable and powered to circulate said gas associated with said produce amongst the produce and in some heat exchange  
25 relationship with or through at least part of a sealing periphery of said sealed produce and its associated gas; and

- (ii) holding the temperature of the sealed produce/gas environment or lowering the temperature of and then holding the temperature of the sealed produce/gas environment at a refrigerating temperature by ensuring a controlled refrigerating  
30 environment outside of said container which is in a heat exchange relationship with said

-3-

at least part of a sealing periphery and hence said said produce/gas environment, while the gas within said container being continuously or continually circulated therein.

Preferably said container is transported, if needed, while within said controlled refrigerating environment.

- 5        Preferably said method also utilises means to control the atmosphere or to provide a displacing gas for the purpose of controlling the gas environment within said transportable container.

Preferably control of said gas environment involves the control of at least one or more of the nitrogen, oxygen, carbon dioxide and ethylene content of the gas environment  
10 within the container.

Preferably there is provided means to maintain the humidity of said gas environment.

Preferably there is provided means to control the humidity of said gas environment.

- Preferably said means to control the humidity of said gas environment utilises a  
15 water trap to collect some or all condensation within the transportable container in a tray.

Preferably heating means is provided to substantially heat said collected condensation so as to raise the humidity within said transportable container.

Preferably said controlled refrigerating environment is that of a refrigerated shipping container, such as, is currently used for refrigerated cargoes.

- 20        Preferably said transportable container includes means internally thereof to raise (preferably under temperature sensor control) the temperature of the circulating gas environment therein (e.g. an electrical heater) to a desired temperature or temperature range above the temperature of said controlled refrigerating environment.

Preferably said means electrical energisable within the container is a fan.

- 25        Preferably the locus of urged circulation of the gas environment is up the walls of the container, over the top of produce stack back down the walls of the container.

Alternatively and preferably if said produce is fruit, vegetables or similar the locus of urged circulation is up the walls of said container across and through the produce at various levels and back down the walls of the container.

- 30        Preferably said container is formed with an outer skin of a conductive material and the gas environment is ducted downwardly by fan means through at least one or a number

-4-

of chambers or ducts defined against, within or between panels forming part of the container to thereafter issue upwardly from below any produce loaded therein (preferably up through a raised floor).

Preferably said containers are formed of a metal such as aluminium and preferably  
5 said containers are formed largely with a double skin spaced apart.

Alternatively said containers are formed by placing a plastics bag over said product, said bag then being braced so as to provide air gaps or ducts around said produce.

Preferably said container carries a controlled atmosphere generating and controlling unit.

10 Preferably that unit is electrically energisable and preferably includes a compressor.

Preferably the compressor is in a direct heat exchange relationship with the refrigerated environment rather than the interior of the transportable container.

Preferably in other forms of the present invention a controlled atmosphere can be ducted into the container from some centralised controlled atmosphere generating unit not  
15 itself carried by the transportable container.

Alternatively each said container may carry its own controlled atmosphere generating unit.

Preferably said container includes heat sensors and means to sense the gas environment and the container has means responsive thereto for the control of the  
20 temperature therewithin and the atmosphere therein.

Alternatively a centralised control system is possible whereby said container includes heat sensors and means to sense the gas environment and a central unit has means responsive thereto for the control of the temperature therewithin and the atmosphere therein.

25 Preferably in the event of a failure of the refrigeration system and/or the atmosphere controlling means, there is provided means whereby controlled quantities of ambient air can enter the sealed transportable container.

Preferably said ambient air enters via the opening of an air inlet.

In a further aspect the present invention consists in a method of transporting,  
30 storing, readying for transporting or storing within the at least partly controlled

-5-

refrigerated environment within a refrigerated container, chamber or hold, produce requiring less refrigeration than the temperature(s), or no lower than the temperature(s), of the refrigerated environment, wherein assemblages of the produce are each sealed within a transportable container having a gas environment in circulation therewithin and  
5 having that gas environment through a wall at least of the transportable container in a heat losing relationship with the refrigerated environment, the individual said transportable containers each having gas environment and/or produce temperature sensing means and gas environment temperature raising means individually responsive to the temperature sensing means should the temperature be below or drop below a predetermined level, the  
10 overall arrangement being such that if desired individual refrigerating temperatures above that of the refrigerated environment can be provided for the individual transportable containers.

Preferably said container is transported, if needed, while within said controlled refrigerating environment.

15 Preferably said method also utilises means to control the atmosphere or to provide a displacing gas for the purpose of controlling the gas environment within said transportable container.

Preferably control of said gas environment involves the control of at least one or more of the nitrogen, oxygen, carbon dioxide and ethylene content of the gas environment  
20 within the container.

Preferably there is provided means to maintain the humidity of said gas environment.

Preferably there is provided means to control the humidity of said gas environment.

Preferably said means to control the humidity of said gas environment utilises a  
25 water trap to collect some or all condensation within the transportable container in a tray.

Preferably heating means is provided to substantially heat said collected condensation so as to raise the humidity within said transportable container.

Preferably said controlled refrigerating environment is that of a refrigerated shipping container, such as, is currently used for refrigerated cargoes.

30 Preferably said transportable container includes means internally thereof to raise (preferably under temperature sensor control) the temperature of the circulating gas

-6-

environment therein (e.g. an electrical heater) to a desired temperature or temperature range above the temperature of said controlled refrigerating environment.

Preferably said means electrical energisable within the container is a fan.

Preferably the locus of urged circulation of the gas environment is up the walls of  
5 the container, over the top of produce stack back down the walls of the container.

Alternatively and preferably if said produce is fruit, vegetables or similar the locus of urged circulation is up the walls of said container across and through the produce at various levels and back down the walls of the container.

Preferably said container is formed with an outer skin of a conductive material and  
10 the gas environment is ducted downwardly by fan means through at least one or a number of chambers or ducts defined against, within or between panels forming part of the container to thereafter issue upwardly from below any produce loaded therein (preferably up through a raised floor).

Preferably said containers are formed of a metal such as aluminium and preferably  
15 said containers are formed largely with a double skin spaced apart.

Alternatively said containers are formed by placing a plastics bag over said product, said bag then being braced so as to provide air gaps or ducts around said produce.

Preferably said container carries a controlled atmosphere generating and controlling unit.

20 Preferably that unit is electrically energisable and preferably includes a compressor.

Preferably the compressor is in a direct heat exchange relationship with the refrigerated environment rather than the interior of the transportable container.

Preferably in other forms of the present invention a controlled atmosphere can be ducted into the container from some centralised controlled atmosphere generating unit not  
25 itself carried by the transportable container.

Alternatively each said container may carry its own controlled atmosphere generating unit.

Preferably said container includes heat sensors and means to sense the gas environment and the container has means responsive thereto for the control of the  
30 temperature therewithin and the atmosphere therein.

Alternatively a centralised control system is possible whereby said container



-7-

includes heat sensors and means to sense the gas environment and a central unit has means responsive thereto for the control of the temperature therewithin and the atmosphere therein.

Preferably in the event of a failure of the refrigeration system and/or the atmosphere  
5 controlling means, there is provided means whereby controlled quantities of ambient air can enter the sealed transportable container.

Preferably said ambient air enters via the opening of an air inlet.

In a further aspect the present invention consists in a method of transporting, storing or readying for transport within in an, at least, partly controlled refrigerated environment  
10 within a refrigerator container, chamber, structure or hold, produce requiring less refrigeration than the temperature(s), or not lower than the temperature(s), of the refrigerated environment wherein assemblages of the produce are each sealed within a transportable container having a gas environment in circulation therewithin and having that gas environment through at least part of a wall at least of the transportable container  
15 in a heat losing relationship within the refrigerated environment, the individual said transportable containers each having at least produce or gas environment temperature sensing means and gas environment temperature raising means individually responsive to the temperature sensing means such that, in use, should the temperature be below or fall below a predetermined level, the gas environment temperature raising means may raise  
20 the temperature within each individual transportable container to the temperature desired above that of the refrigerated environment.

Preferably, each transportable container, or at least one of the transportable containers, includes a controlled atmosphere gas environment therein (preferably as herein described).

25 In still a further aspect the present invention consists in a sealable transportable container suitable for use in any method in accordance with the present invention.

In yet a further aspect the present invention consists in a transportable container suitable for use in a method in accordance with the present invention comprising:

means providing a box form having a closable and sealable opening thereto  
30 to allow the loading and unloading of produce thereinto;

-8-

at least a partial inner wall defining a ducting space against the outer panel of at least one of the sides of the box form down which the gas environment can be passed;

means electrically energisable disposed at an upper position within the box form to draw a gas environment therewithin upwardly through any produce stacked on the  
5 bottom of the box form or some raised floor or skeletal floor thereof and to direct the gas environment downwardly through said ducting space so as to be in a heat exchange (preferably in use losing) relationship with any refrigerated environment outside of the box forms;

an electrically operable atmosphere control unit responsive to the atmosphere  
10 within the box form capable of controlling at least one of the gases nitrogen, oxygen, carbon dioxide and ethylene in said atmosphere; and

electrically energisable heating means disposed in the locus of the in use gas movement under the action of said means electrically energisable capable of raising the temperature of that circulating gas environment should the temperature within the  
15 transportable box form drop below a predetermined or preset minimum.

Preferably said box form is rectanguloid or cuboid.

Preferably said at least a partial inner wall is defined by the produce or cartons of produce.

Preferably a layer of insulating material is provided in association with said sealing  
20 means, said insulating material preferably been sized to ensure that the internal temperature of said transportable container is suitable.

Preferably said electrically operable atmosphere control unit is directly associated with each said transportable container.

Alternatively wherein said electrically operable atmosphere control unit is remote  
25 from said transportable container.

Preferably said means electrically energisable or otherwise forcing to circulate the gas environment is housed within an upper part of said time when in use.

Preferably said means electrically energisable or otherwise forcing is a fan preferably variable speed.

30 Preferably said sealing means comprising a plastics bag or similar sheeting.

Preferably said plastics bag is at least gas semi-permeable with respect to certain

gases, for example, ethylene.

Preferably said forklift carriable pallet is of a standard type.

In yet a further aspect, the present invention consists in a transportable container suitable for use in a method in accordance with the present invention comprising:

- 5 means providing a box form having a closeable and sealable opening thereto to allow the loading and unloading of produce thereinto;

at least a partial inner wall defining a ducting space outside the outer panel of at least one of the sides of the box form through which the gas environment can be passed;

- means to allow the circulation of a gas environment therewithin through any  
10 produce stacked on the bottom of the box form or some raised floor or skeletal floor thereof and through said ducting space so as to be in the heat exchange (preferably, in use, losing) relationship with any refrigerated environment outside of the box forms, whether the circulation be by circulation means or by convection;

- electrically energisable heating means disposed in the locus of the in use gas  
15 movement capable of raising the temperature of that circulating gas environment should the temperature within the transportable box form drop below a predetermined or preset minimum.

Preferably said apparatus is substantially as hereinafter defined with or without reference to specific embodiments.

- 20 Preferably said at least a partial inner wall is defined by the produce or cartons of produce.

Preferably a layer of insulating material is provided in association with said sealing means, said insulating material preferably been sized to ensure that the internal temperature of said transportable container is suitable.

- 25 Preferably said electrically operable atmosphere control unit is directly associated with each said transportable container.

Alternatively wherein said electrically operable atmosphere control unit is remote from said transportable container.

- Preferably said means electrically energisable or otherwise forcing to circulate the  
30 gas environment is housed within an upper part of said time when in use.

Preferably said means electrically energisable or otherwise forcing is a fan

-10-

preferably variable speed.

Preferably said sealing means comprising a plastics bag or similiar sheeting.

Preferably said plastics bag is at least gas semi-permiable with respect to certain gases, for example, ethylene.

5 Preferably said forklift carriable pallet is of a standard type.

In yet a further aspect, the present invention consists in a transportable container suitable for use in a method in accordance with the present invention comprising:

means providing a box form having a closeable and sealable opening thereto to allow the loading and unloading of produce thereinto;

10 at least a partial inner wall defining a ducting space outside the outer panel of at least one of the sides of the box form through which the gas environment can be passed;

means to allow the circulation of a gas environment therewithin through any produce stacked on the bottom of the box form or some raised floor or skeletal floor thereof and through said ducting space so as to be in the heat exchange (preferably, in use,

15 losing) relationship with any refrigerated environment outside of the box forms, whether the circulation be by circulation means or by convection;

electrically energisable heating means disposed in the locus of the in use gas movement capable of raising the temperature of that circulating gas environment should the temperature within the transportable box form drop below a predetermined or preset

20 minimum.

Preferably said at least a partial inner wall is defined by the produce or cartons of produce.

Preferably a layer of insulating material is provided in association with said sealing means, said insulating material preferably been sized to ensure that the internal  
25 temperature of said transportable container is suitable.

Preferably said electrically operable atmosphere control unit is directly associated with each said transportable container.

Alternatively wherein said electrically operable atmosphere control unit is remote from said transportable container.

30 Preferably said means electrically energiseable or otherwise forcing to circulate the gas environment is housed within an upper part of said time when in use.

-11-

Preferably said means electrically energiseable or otherwise forcing is a fan preferably variable speed.

Preferably said sealing means comprising a plastics bag or similiar sheeting.

Preferably said plastics bag is at least gas semi-permiable with respect to certain  
5 gases, for example, ethylene.

Preferably said forklift ~~carriable~~ pallet is of a standard type.

Preferably said apparatus is substantially as hereinafter defined with or without reference to specific embodiments.

In yet another aspect the present invention consists in a transportable item  
10 comprising:

a forklift ~~carriable~~ pallet;

sealing means;

produce, said produce being sealed within said sealing means and on said  
pallet;

15 said container having associated therewith means electrically energiseable or otherwise forcing to circulate the gas environment within said transportable container when said sealing means is substantially sealed;

the temperature of the environment within said container being capable of being effected by heat exchange from said circulating gas environment through at least  
20 part of at least one wall of said transportable container;

means to control the temperature within said transportable container such that said temperature is held or lowered and then held.

Preferably said at least a partial inner wall is defined by the produce or cartons of produce.

25 Preferably a layer of insulating material is provided in association with said ~~sealing~~ means, said insulating material preferably been sized to ensure that the internal temperature of said transportable container is suitable.

Preferably said electrically operable atmosphere control unit is directly associated with each said transportable container.

30 Alternatively wherein said electrically operable atmosphere control unit is remote from said transportable container.

-12-

Preferably said means electrically energiseable or otherwise forcing to circulate the gas environment is housed within an upper part of said time when in use.

Preferably said means electrically energiseable or otherwise forcing is a fan preferably variable speed.

5 Preferably said sealing means comprising a plastics bag or similar sheeting.

Preferably said plastics bag is at least gas semi-permiable with respect to certain gases, for example, ethylene.

Preferably said forklift carriable pallet is of a standard type.

The invention consists in the foregoing and also envisages constructions of which  
10 the following gives examples.

#### **BRIEF DESCRIPTION OF INVENTION**

Preferred forms of the present invention will now be described with reference to the accompanying drawings in which;

Figure 1 shows a conventional 40 foot refrigerated sea container 101 with a  
15 transportable container 100 in accordance with the present invention positioned internally thereof so as to take advantage of the refrigerated environment thereof, the arrows showing how there is provision below, about and above the transportable container within the refrigerated sea container for the air of the refrigerated environment to be ducted from and back to a standard refrigerated sea container refrigeration unit;

20 Figure 2 shows a similar arrangement as shown in Figure 1 but showing this time two transportable containers 100 in accordance with the present invention positioned therewithin, it being possible in some embodiments of the present invention to provide the gas environment (whatever it might be) within each transportable container 100 in the refrigerated sea container 101 with a temperature at or above the air temperature about the  
25 transportable containers;

Figure 3 is a perspective view showing as a transparent item a refrigerated sea container 101 having positioned therewithin as in Figure 2 two transportable containers 100 in accordance with the present invention, there being shown the refrigeration unit of the sea container at the left hand end, rollers carried by the transportable containers and/or  
30 the sea container to facilitate loading and avoid excessive movement during transit, there being shown the movement of the refrigerated air of the sea container 101 by the arrows,

-13-

and showing at the right hand end of the right hand transportable container an access opening into the transportable container 100 which preferably seals without reliance upon a sealing curtain as well as the carried control unit(s) and atmosphere control system of the transportable container;

5        Figure 4 is an end view of a transportable container 100 in accordance with the present invention positioned within a sea container as in Figure 3;

Figure 5 is a cross section of a transportable container 100 in accordance to a preferred form of the present invention showing the gas circulation therewithin under the action of preferably a single or a series of centrifugal fans positioned at the top of the box  
10 form of the transportable container and showing the ducting of that gas environment downwardly through ducts making a heat exchange contact with the outer skin of the transportable container 100 before infusing upwardly through the floor or a raised floor through the produce (whether cartoned, shelved, basketed or the like);

Figure 6 is a plan view of a transportable container 100 showing a disposition of two  
15 centrifugal fans below the top skin of the box form which has been removed for the purpose of explanation;

Figure 7 is a similar view to that of Figure 6 but this time showing a preferred floor which facilitates the infusion of downwardly ducted gas in the atmosphere of the transportable container 100 evenly upwardly through the produce stacked thereon;

20        Figure 7a shows a possible airtight seal system for the access door or opening of the container as depicted in Figure 7;

Figure 8 is the design of one preferred form of the present invention showing how a control unit associable within the box form of a transportable container in accordance with the present invention can be provided to include an electrical connection to power  
25 all of the electrically energisable componentry to be carried with the transportable container, to locate an air or gas treating unit with an air compressor in a direct heat exchange outside of the sealed gas atmosphere of the transportable container and showing how the unit can carry a closeable storage area for a carbon dioxide source such as either dry ice or carbon dioxide cylinders;

30        Figure 9 shows an alternative arrangement of transportable containers 100 within a shipping container 101, in this case the transportable containers abut one another and

-14-

an air gap is provided between the outer walls of transportable container and the inner walls of the shipping container;

Figure 10 shows another alternative arrangement of transportable containers within a shipping container, in this case the transportable containers substantially abut the inner walls of the shipping container and air gaps or ducts, are provided between the transportable containers or rows of containers;

Figure 11 shows yet another alternative arrangement of transportable containers within a shipping container wherein air gaps are provided both between the individual transportable containers and the inner walls of the shipping container; and

Figure 12 shows the most preferred form of the present invention wherein a pallet is provided upon which is stacked produce, the product being fully encased in a, for example, plastics bag, a fan is provided as is a fan cap to provide for the sealing of said plastics bag, the air is circulated such that it flows down through a gap provided between the produce and the plastics bag, through said produce and up an air gap provided on the opposite side between said produce and said plastics bag. Heat exchange occurs through the walls of the plastics bag.

#### **BEST MODES FOR CARRYING OUR INVENTION**

While in the preferred form, specific embodiments are depicted, obviously the scope of the invention is as previously defined.

The present invention realises the difficulty that the provision of purpose built refrigerated sea containers pose if a controlled atmosphere system is to be utilised in conjunction with the normal refrigeration of such sea containers. These difficulties arise because: i) it is generally difficult to control the cargo temperature accurately enough within such refrigerated sea containers for fresh perishable produce since many of the existing stock of refrigerated sea containers are designed to transport frozen rather than chilled produce; ii) existing refrigerated sea containers are not generally able to create or maintain the desired normal high level of humidity which is required for the majority of perishable produce; iii) gas and/or air circulation in such existing stock of refrigerated sea containers is normally below the standard required for adequate maintenance of perishable produce; iv) the existing stock of refrigerated sea containers are not generally sufficiently gas tight for the purpose and tend to allow the atmosphere to leak at a generally



-15-

unmanageable rate.

To manufacture a purpose built refrigerated sea container that would overcome the aforementioned difficulties would be expensive and renders obsolete much of the existing stock of refrigerated transportation containers. The present invention, therefore, has applicability to existing refrigerated ships, coolrooms as well as existing refrigerated transportation containers.

Figure 1 shows a circulation of air around the transportable container 100 which is contained within a forty foot refrigerated sea container 101. The air flows up the sides and over the top of the transportable container and is drawn into the sea container's refrigeration unit labelled 1. The said refrigeration unit cools the air and pumps it back down under the transportable container. The warm air is drawn in through the inlet 2 and the cooled air emerges through the outlet labelled 3.

Referring to Figure 2, the situation is similar, however, the forty foot refrigerated sea container 101 contains two transportable containers 100 internally. Again, the air flows up the sides and over the top of the transportable containers and it is drawn into the sea container's refrigeration unit through inlet 2 and the cooled air is driven out the outlet labelled 3.

Referring to Figure 3, the air circulation pattern is shown around the six sides of the internal transportable containers. The air flows through the ducts which are provided by the gap or space between the inside walls of the sea container and the outside walls of the internal transportable container.

Referring to Figure 4, an end view of the transportable container positioned inside the sea container is shown. The transportable container 100 is shown with rollers 5 which provide the gap between the internal wall of the sea container and the external wall of the transportable container. The transportable container has a door 6 which enables produce to be placed inside the transportable container, this door is shown closed in the Figure.

The control system 7 of the transportable container is shown in the Figure to the right of the door.

A dry ice bunker 8, which is preferably insulated, is shown. In another preferred embodiment of the invention this bunker is a cavity for gas pressure cylinders.

The computer panel for monitoring of gas and/or temperature levels and/or the

-16-

changing of set gas and/or temperature levels is shown 9. A compressor, which is preferably of the oilless type is shown below the computer panel labelled 10.

Referring to Figure 5, air is drawn up the sides and through the stacked cartons of produce or produce itself 11 through the air gaps 30 around the sides and in the base and top of the cartons. The air is drawn up by a fan 12 and the air passes a temperature probe 13 which monitors inside and outside temperatures. This probe is connected to the computer system.

Although in the preferred embodiment, a fan 12 is used to provide the circulation means, other circulation means could be used or, in use, convection currents set up by the heating means forming part of this invention within the transport container may provide sufficient circulation, particularly for some types of produce.

Referring to Figure 6, the top of the transportable container is illustrated. Shown are the variable speed fans 13. Shown also are the bracings for the roof 15 in between the outer and inner roof. These direct the flow of air away from the fans. The air flows down the duct 30 provided by the gap between the produce and the transportable container. This gap is maintained by "T" rail braces and/or corrugations.

In an alternative form of the invention, there are two rows of fans. An air gap is maintained between the cartons of produce and the inner side of the outer wall of the transportable container by raised "T" sections. Air is drawn up through the cargo by the fans and directed between the outer and interior roof and outer and interior walls of the transportable container. The air mixture is vented in several directions flowing in between the said gap across the top of the roof, down the walls and in between the spaces in the "T" section floor. It is then drawn up again through the produce, therefore, completing one revolution of the air circulation cycle.

When the product is at the correct temperature as measured by the temperature probe 13 the fans may be slowed down which would have the effect of reducing moisture loss of the product.

In another form of the invention, the outer sides of the transportable container are not flat surfaces but have corrugated sides. This larger surface area would speed up the rate of heat transfer.

It is preferred that the transportable container's control systems are connected to the

-17-

sea container's refrigeration control system. This provides the ability for the transportable container to have some control over the sea container's refrigeration system. When the sea container's refrigeration system goes into defrost normally its fans stop. The transportable container's control system would ensure that the fans would be kept running  
5 during defrost. The system would stay in defrost mode until the outer metal sides of the transportable container are raised above 0°C. At this temperature, any ice built up on the inside of the six outer metal surfaces would melt. While this process is in action, the transportable container's fans would be turned off.

It is anticipated that the transportable container 100 will be manufactured in a  
10 number of different dimensions, for example, there is significant commercial advantage in being able to transport more than one type of fresh product in one container. Two or more transportable containers 100 could fit into one sea container 101. These transportable containers 100 could contain different products kept at different temperatures.

15 In one form of the invention the sea container's 101 temperature is set to the lowest storage temperature of the products. The transportable container's heating mechanism is then used to keep the temperature in the transportable containers with other products at higher temperatures.

Preferably, the transportable container will draw its refrigeration from an external  
20 source. However, in certain situations it may be that some models will contain or have attached their own refrigeration equipment. In this case, an insulated cover would be placed around any or all of its metal sides.

It is preferable that the transportable container be fitted with its own controlled atmosphere generation equipment similar to that described in Transphere's US Patent No.  
25 5063753 the full content of which is herein incorporated by way of reference. However, this equipment could be mounted into or attached to the outside of the sea container itself. Connecting pipes will be required to allow gas to flow between the transportable containers gas atmosphere and control system.

Although the following description relates to a preferred method wherein the gas  
30 environment is also controlled, in the case of some produce such as carrots and, particularly for brief storage or transport, there is no necessity to control the composition

-18-

of the gas environment but merely the temperature. However, for longer storage or transport of produce and, in particular, produce which is more susceptible to high rates of senescence, the gas environment composition must also be controlled.

Preferably, the system will supply nitrogen, oxygen, carbon dioxide on demand and  
5 with certain products it will also supply ethylene gas on demand. Preferably, the system will also consist of a method of scrubbing carbon dioxide and/or ethylene gas from the transportable container cargo area.

There are a number of options for the atmosphere control systems. One of these is a flushing system which draws air in through a membrane and pumps it into the  
10 transportable container's cargo area under pressure. This has the effect of flushing out the atmosphere inside via pressure outlets until desired levels of oxygen and carbon dioxide are reached.

A recirculatory system recycles the cargo atmosphere through the membrane which is used to remove oxygen, carbon dioxide and ethylene. Removal of some of these gasses  
15 requires that others take their place. The membrane would either replace with enriched nitrogen gas or air or a mixture of both would be added.

Chemicals and/or plastics or other types of fibres could be used to remove oxygen and/or carbon dioxide from the atmosphere. It would require a system of controls that cycled the transportable container air mixture so that it was in contact with the chemicals  
20 or fibres.

A gas purge system could be provided whereby gas is purged into the transportable container cargo area at mixtures and levels determined by the control system.

If the oxygen level in the cargo area goes below its set point then the system will either draw in outside or process outside air through the membrane which instead of  
25 directing a nitrogen enriched stream into the cargo area may direct an oxygen enriched stream.

The proposed controlled atmosphere system may use any combination of any one, or more of the above techniques to control its cargo atmosphere.

Another possibility is the use of active films, for example there are films available  
30 which provide for the absorption of carbon dioxide or ethylene. The use of an ethylene film to seal fruit will to a certain extent slow down its ripening and thus maintain its

value.

In the event that power is cut off to the transportable container the controlled atmosphere system would automatically open the air vents or inlet valves. This is required to stop the atmosphere going anaerobic or the CO<sub>2</sub> level becoming too high.

- 5       The transportable container may contain a battery back up unit to provide back up power to the transportable container.

The atmosphere in the transportable container 100 can be sealed gas tight to a level much better than if a controlled atmosphere system was fitted into the sea container without the transportable container, therefore, the requirement for large amounts of gas  
10 to compensate for high leakage is not thought to be required. This means that the transportable container controlled atmosphere system can be downsized which results in cost saving and reduced power consumption.

As air is cooled it shrinks producing a negative pressure build up inside the transportable container and as the air temperature rises the air expands producing a  
15 positive pressure build up inside the transportable container. This pressure may be controlled by a pressure sensitive device which is designed to keep the transportable container under optimum positive pressure. Preferably, the device will be connected into the transportable container and exhaust its internal atmosphere, or let external air to the transportable container's cargo area in compensation for changing environmental pressure.

- 20       In other forms of the invention, there is fitted an alarm system which will provide an alert about security breaches or certain adverse conditions, eg. a power off or oxygen level too low or too high.

In another form of the invention environments can be created where it is possible to grow plants in transit or better preserve them. One aid to this is an infusion of light at  
25 programmed intervals.

It is anticipated that at least two different atmosphere systems Type I and Type II will be alternatively offered as a source of gas supply to the transportable container. Preferably one of these is fitted to a transportable container although both may be fitted to provide a backup.

- 30       Type I consists of a nitrogen generator, preferably, a hollow fibre membrane or a PSA system, a CO<sub>2</sub> supply source either dried ice or a pressure cylinder, oxygen carbon

-20-

dioxide gas analyses, a PLC controller or similar computer control system, solenoid valves, flow valve, an oilless compressor and, optionally, data recorders for temperature, oxygen and carbon dioxide gasses.

An alternative system, Type II, would consist of a liquid nitrogen pressure vessel,  
5 pressure vessels containing CO<sub>2</sub>, an optional dry ice system for CO<sub>2</sub> supply, oxygen and carbon dioxide gas analysers, PLC controllers or a similar computer control system and solenoid valves.

Although the majority of this description relates to the provision of transportable or portable containers, the technology described could equally be used in the provision of  
10 fixed containers for coolrooms and the like and provide an alternative to upgrading the coolroom itself and/or provide better control over temperature and gas environment for produce in the coolroom. The system also allows a variety of different temperatures and/or gas environments to be maintained in different containers within a single refrigerated coolroom.

15 The most preferred form of the present invention is as illustrated in Figure 12. A pallet 52 is provided on to which cartons 11 of produce is loaded surrounding the produce is a sealing means, preferably a plastics bag 56, the plastics bag 56 is spaced apart from the produce cartons 11 thus providing a duct 30. Present in at least fluid communication with said plastics bag 56 is an electrically energisable means to circulate the gas  
20 environment preferably a fan 12. This fan may be of variable speed type or may simply consist of a single speed fan. Surrounding said fan 12 and provided for the sealing of said bag is a fan cap 54. In forms of the invention contained within said bag 56 are atmospheric scrubbing devices or means 53. These means may consist of desiccating elements or devices or devices which absorb specific gases such as ethylene.

25 The flow of air forced by said fan 12 is as shown in the figures, the air flows down the duct 30 provided between the plastics bag 56 and the produce 11 through the cartons of produce 11 and up the duct on the opposite side formed between the plastics bag 56 and the cartons of produce 11. A heat exchange relationship 50 exists through the side walls of the transportable container 100. Especially preferred forms of the invention a  
30 service line 54 is provided in the most basic forms of the invention, this service line may simply provide for power of the fan 12, in other forms the service line may provide for

-21-

monitoring and/or control of the atmosphere contained within said transportable container.

- In forms of the present invention the plastics bag 56 may comprising a, for example, gas semi-permeable plastics, this plastics material may, for example, allow for the exit of ethylene but substantially prevent the exit of other gases. In other forms of the invention
- 5 an insulated outer container may be provided over said plastics bag. The thickness of this insulated material may be selected so as to provide for the best internal environment, eg temperature, within said transportable container. In forms of the invention temperature raising means 120 such as a resistance heated are provided to reuse the temperature of the internal environment within the said transportable container if required.

-22-

**WHAT WE CLAIM IS:**

1. A method of transporting, storing (or readying for transport or storing) perishable produce which comprises;

(i) loading and sealing the produce into a sealable transportable container or onto  
5 a pallet (hereinafter "container") to substantially isolate gas associated with said produce from the surrounding environment, said container or pallet having

means electrically energisable or otherwise actuable and powered to circulate said gas associated with said produce amongst the produce and in some heat exchange relationship with or through at least part of a sealing periphery of said sealed produce and  
10 its associated gas; and

(ii) holding the temperature of the sealed produce/gas environment or lowering the temperature of and then holding the temperature of the sealed produce/gas environment at a refrigerating temperature by ensuring a controlled refrigerating environment outside of said container which is in a heat exchange relationship with said  
15 at least part of a sealing periphery and hence said said produce/gas environment, while the gas within said container being continuously or continually circulated therein.

2. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claim 1 wherein said container is transported, if needed, while within said controlled refrigerating environment.

20 3. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claim 1 or 2 wherein said method also utilises means to control the atmosphere or to provide a displacing gas for the purpose of controlling the gas environment within said container.

4. A method of transporting, storing (or readying for transport or storing) perishable  
25 produce as claimed in claim 3 wherein said control of said gas environment involves the control of at least one or more of the nitrogen, oxygen, carbon dioxide and ethylene content of the gas environment within the container.

5. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 4 wherein there is provided means to  
30 maintain the humidity of said gas environment.



-23-

6. A method of transporting, storing (or readying for transport, or storing) perishable produce as claimed in any one of claims 1 to 5 wherein there is provided means to control the humidity of said gas environment.
7. A method of transporting, storing (or readying for transport or storing) perishable  
5 produce as claimed in claim 6 wherein said means to control the humidity of said gas environment utilises a water trap to collect some or all condensation within the transportable container in a tray.
8. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claim 7 wherein heating means is provided to substantially heat said  
10 collected condensation so as to raise the humidity within said transportable container.
9. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 8 wherein said controlled refrigerating environment is that of a refrigerated shipping container or refrigerated vehicle, such as, is currently used for refrigerated cargoes.
- 15 10. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 9 wherein said transportable container includes means internally thereof to raise (preferably under temperature sensor control) the temperature of the circulating gas environment therein (e.g. an electrical heater) to a desired temperature or temperature range above the temperature of said controlled  
20 refrigerating environment.
11. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 10 wherein said means electrical energisable within the container is a fan.
12. A method of transporting, storing (or readying for transport or storing) perishable  
25 produce as claimed in any one of claims 1 to 11 wherein the locus of urged circulation of the gas environment is up the walls of the container, over the top of produce stack back down the walls of the container.
13. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 11 wherein the locus of urged circulation is  
30 up the walls of said container across and through the produce at various levels and back down the walls of the container.

-24-

14. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 13 wherein said container is formed with an outer skin of a conductive material and the gas environment is ducted downwardly by fan means through at least one or a number of chambers or ducts defined against, within or  
5 between panels forming part of the container to thereafter issue upwardly from below any produce loaded therein (preferably up through a raised floor).
15. A method of transporting, storing (or readying for transport, or storing) perishable produce as claimed in any one of claims 1 to 14 wherein said containers are formed of a metal such as aluminium and preferably said containers are formed largely with a double  
10 skin spaced apart.
16. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 14 wherein said containers are formed by placing a plastics (which may be gas permeable with respect to certain gases) bag over said product, said bag then being braced so as to provide air gaps or ducts around said  
15 produce.
17. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 16 wherein said container carries a controlled atmosphere generating and controlling unit.
18. A method of transporting, storing (or readying for transport or storing) perishable  
20 produce as claimed in claims 17 wherein said controlled atmosphere generating and controlling unit is electrically energisable and preferably includes a compressor.
19. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 18 wherein said compressor is in a direct heat exchange relationship with the refrigerated environment rather than the interior of the  
25 transportable container.
20. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 16 wherein a controlled atmosphere can be ducted into the container from some centralised controlled atmosphere generating unit not itself carried by the transportable container.
- 30 21. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 16 wherein each said container may carry

-25-

its own controlled atmosphere generating unit.

22. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 21 wherein said container includes heat sensors and means to sense the gas environment and the container has means responsive  
5 thereto for the control of the temperature therewithin and the atmosphere therein.

23. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 21 wherein a centralised control system is possible whereby said container includes heat sensors and means to sense the gas environment and a central unit has means responsive thereto for the control of the  
10 temperature therewithin and the atmosphere therein.

24. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 1 to 23 wherein in the event of a failure of the refrigeration system and/or the atmosphere controlling means, there is provided means whereby controlled quantities of ambient air can enter the sealed transportable container.

15 25. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claims 24 wherein said ambient air enters via the opening of an air inlet.

26. A method of transporting, storing (or readying for transport or storing) within the at least partly controlled refrigerated environment within a refrigerated container, chamber  
20 or hold, produce requiring less refrigeration than the temperature(s), or no lower than the temperature(s), of the refrigerated environment, wherein assemblages of the produce are each sealed within a transportable container having a gas environment in circulation therewithin and having that gas environment through at least part of a wall at least of the transportable container in a heat losing relationship with the refrigerated environment, the  
25 individual said transportable containers each having gas environment and/or produce temperature sensing means and gas environment temperature raising means individually responsive to the temperature sensing means should the temperature be below or drop below a predetermined level, the overall arrangement being such that if desired individual refrigerating temperatures above that of the refrigerated environment can be provided for  
30 the individual transportable containers.

27. A method of transporting, storing (or readying for transport or storing) perishable

-26-

produce as claimed in claim 26 wherein said container is transported, if needed, while within said controlled refrigerating environment.

28. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claim 26 or 27 wherein said method also utilises means to control  
5 the atmosphere or to provide a displacing gas for the purpose of controlling the gas environment within said container.

29. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claim 28 wherein said control of said gas environment involves the control of at least one or more of the nitrogen, oxygen, carbon dioxide and ethylene  
10 content of the gas environment within the container.

30. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 26 to 29 wherein there is provided means to maintain the humidity of said gas environment.

31. A method of transporting, storing (or readying for transport, or storing) perishable  
15 produce as claimed in any one of claims 26 to 30 wherein there is provided means to control the humidity of said gas environment.

32. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claim 31 wherein said means to control the humidity of said gas environment utilises a water trap to collect some or all condensation within the  
20 transportable container in a tray.

33. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claim 32 wherein heating means is provided to substantially heat said collected condensation so as to raise the humidity within said transportable container.

34. A method of transporting, storing (or readying for transport or storing) perishable  
25 produce as claimed in any one of claims 26 to 33 wherein said controlled refrigerating environment is that of a refrigerated shipping container or refrigerated vehicle, such as, is currently used for refrigerated cargoes.

35. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 26 to 34 wherein said transportable container  
30 includes means internally thereof to raise (preferably under temperature sensor control) the temperature of the circulating gas environment therein (e.g. an electrical heater) to a

-27-

desired temperature or temperature range above the temperature of said controlled refrigerating environment.

36. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 26 to 35 wherein said means electrical  
5   enables within the container is a fan.

37. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 26 to 35 wherein the locus of urged circulation of the gas environment is up the walls of the container, over the top of produce stack back down the walls of the container.

10 38. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 26 to 37 wherein the locus of urged circulation is up the walls of said container across and through the produce at various levels and back down the walls of the container.

39. A method of transporting, storing (or readying for transport or storing) perishable  
15   produce as claimed in any one of claims 26 to 38 wherein said container is formed with an outer skin of a conductive material and the gas environment is ducted downwardly by fan means through at least one or a number of chambers or ducts defined against, within or between panels forming part of the container to thereafter issue upwardly from below any produce loaded therein (preferably up through a raised floor).

20 40. A method of transporting, storing (or readying for transport, or storing) perishable produce as claimed in any one of claims 26 to 39 wherein said containers are formed of a metal such as aluminium and preferably said containers are formed largely with a double skin spaced apart.

41. A method of transporting, storing (or readying for transport or storing) perishable  
25   produce as claimed in any one of claims 26 to 40 wherein said containers are formed by placing a plastics (which may be gas permeable with respect to certain gases) bag over said product, said bag then being braced so as to provide air gaps or ducts around said produce.

42. A method of transporting, storing (or readying for transport or storing) perishable  
30   produce as claimed in any one of claims 26 to 41 wherein said container carries a controlled atmosphere generating and controlling unit.

43. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claims 42 wherein said controlled atmosphere generating and controlling unit is electrically energisable and preferably includes a compressor.
44. A method of transporting, storing (or readying for transport or storing) perishable  
5 produce as claimed in any one of claims 26 to 43 wherein said compressor is in a direct heat exchange relationship with the refrigerated environment rather than the interior of the transportable container.
45. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 26 to 44 wherein a controlled atmosphere can be  
10 ducted into the container from some centralised controlled atmosphere generating unit not itself carried by the transportable container.
46. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 26 to 45 wherein each said container may carry its own controlled atmosphere generating unit.
- 15 47. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in any one of claims 26 to 46 wherein said container includes heat sensors and means to sense the gas environment and the container has means responsive thereto for the control of the temperature therewithin and the atmosphere therein.
48. A method of transporting, storing (or readying for transport or storing) perishable  
20 produce as claimed in any one of claims 26 to 47 wherein a centralised control system is possible whereby said container includes heat sensors and means to sense the gas environment and a central unit has means responsive thereto for the control of the temperature therewithin and the atmosphere therein.
49. A method of transporting, storing (or readying for transport or storing) perishable  
25 produce as claimed in any one of claims 26 to 48 wherein in the event of a failure of the refrigeration system and/or the atmosphere controlling means, there is provided means whereby controlled quantities of ambient air can enter the sealed transportable container.
50. A method of transporting, storing (or readying for transport or storing) perishable produce as claimed in claims 49 wherein said ambient air enters via the opening of an air  
30 inlet.
51. A method of transporting, storing, readying for transport, storage or readying for

-29-

storing within the at least partly controlled refrigerated environment within a refrigerated container, chamber or hold, produce requiring less refrigeration than the temperature(s), or no lower than the temperature(s), of the refrigerated environment, wherein assemblages of the produce are each sealed within a transportable container having a gas environment  
5 in circulation therewithin and having that gas environment through at least part of a at least part of wall at least of the transportable container in a heat losing relationship with the refrigerated environment, the individual said transportable containers each having gas environment and/or produce temperature sensing means and gas environment temperature raising means individually responsive to the temperature sensing means should the  
10 temperature be below or drop below a predetermined level, the overall arrangement being such that if desired individual refrigerating temperatures above that of the refrigerated environment can be provided for the individual transportable containers.

52. A method of transporting, storing as claimed in claim 51 wherein each transportable container or at least one of the transportable containers includes a controlled atmosphere  
15 gas environment therein (preferably as herein described).

53. A method of transporting, storing or readying for storage or transport within in an, at least, partly controlled refrigerated environment within a refrigerator container, chamber, structure or hold, produce requiring less refrigeration than the temperature(s), or not lower than the temperature(s), of the refrigerated environment wherein assemblages  
20 of the produce are each sealed within a transportable container having a gas environment in circulation therewithin and having that gas environment through at least part of a wall at least of the transportable container in a heat losing relationship within the refrigerated environment, the individual said transportable containers each having at least produce or gas environment temperature sensing means and gas environment temperature raising  
25 means individually responsive to the temperature sensing means such that, in use, should the temperature be below or fall below a predetermined level, the gas environment temperature raising means may raise the temperature within each individual transportable container to the temperature desired above that of the refrigerated environment.

54. A method of transporting, storing or readying for transport as claimed in claim 55  
30 wherein each transportable container, or at least one of the transportable containers, includes a controlled atmosphere gas environment therein.

-30-

55. A method of transporting, storing as claimed in any one of claims 1 to 54 wherein the atmosphere contained within said transportable container is controlled remotely.
56. A method of transporting, storing or readying for transport or storing as claimed in any one of claims 1 to 55 wherein said atmosphere is controlled by a unit mounted on or  
5 in said transportable container.
57. A method of transporting, storing, (or readying for transport or storing) as claimed in any one of claims 1 to 56 wherein a layer of insulating material is provided in association with said sealing means, said insulating means being of a sufficient thickness to ensure the produce is maintained at a required temperature.
- 10 58. A sealable transportable container suitable for use in any method as claimed in any one of claims 1 to 7 in accordance with the present invention.
59. A transportable container comprising:
- means providing a box form having a closable and sealable opening thereto to allow the loading and unloading of produce thereinto;
- 15 at least a partial inner wall defining a ducting space against the outer panel of at least one of the sides of the box form down which the gas environment can be passed;
- means electrically energisable or otherwise forcing disposed at an upper position within the box form to draw a gas environment therewithin upwardly through any produce stacked on the bottom of the box form or some raised floor or skeletal floor  
20 thereof and to direct the gas environment downwardly through said ducting space so as to be in a heat exchange (preferably in use losing) relationship with any refrigerated environment outside of said box forms;
- an electrically operable atmosphere control unit responsive to the atmosphere within the box form capable of controlling at least one of the gases nitrogen, oxygen,  
25 carbon dioxide and ethylene in said atmosphere; and
- electrically energisable or otherwise heating means disposed in the locus of the in use gas movement under the action of said means electrically energisable or otherwise heating capable of raising the temperature of that circulating gas environment should the temperature within the transportable box form drop below a predetermined or  
30 preset minimum.



-31-

60. A transportable container as claimed in claim 58 or 59 wherein said at least a partial inner wall is defined by the produce or cartons of produce.
61. A transportable container as claimed in any one of claims 58 to 60 wherein a layer of insulating material is provided in association with said sealing means, preferably said
- 5 insulating material is sized so as to ensure the content of said transportable container are maintained at a suitable temperature.
62. A transportable container as claimed in any one of claims 58 to 61 wherein said electrically energisable or otherwise heating means is a resistance heater.
63. A transportable container as claimed in any one of claims 58 to 62 wherein said
- 10 atmosphere control unit is directly associated with each said transportable container.
64. A transportable container as claimed in any one of claims 58 to 62 wherein said atmosphere control unit is remote from said transportable container.
65. A transportable container comprising:
- means providing a box form having a closable and sealable opening thereto
- 15 to allow the loading and unloading of produce thereinto;
- at least a partial inner wall defining a ducting space against the outer panel of at least one of the sides of the box form through which the gas environment can be passed;
- means electrically energisable or otherwise forcing disposed at an upper position within the box form to draw a gas environment therewithin through any produce
- 20 stacked on the bottom of the box form or some raised floor or skeletal floor thereof and to direct the gas environment through said ducting space so as to be in a heat exchange (preferably, in use, losing) relationship with any refrigerated environment outside of said box forms;
- an electrically operable atmosphere control unit responsive to the atmosphere
- 25 within the box form capable of controlling at least one of the gases nitrogen, oxygen, carbon dioxide and ethylene in said atmosphere; and
- electrically energisable or otherwise heating means disposed in the locus of the in use gas movement under the action of said means electrically energisable or otherwise heating capable of raising the temperature of that circulating gas environment
- 30 should the temperature within the transportable box form drop below a predetermined or

-32-

preset minimum.

66. A transportable container as claimed in claim 57 or 65 wherein said at least a partial inner wall is defined by the produce or cartons of produce.

67. A transportable container as claimed in claim 57 or 65 or 66 wherein a layer of  
5 insulating material is provided in association with said sealing means, said insulating material preferably been sized to ensure that the internal temperature of said transportable container is suitable.

68. A transportable container as claimed in claim 57 or 64 to 66 wherein said electrically operable atmosphere control unit is directly associated with each said  
10 transportable container.

69. A transportable container as claimed in claim 57 or 65 to 67 wherein said electrically operable atmosphere control unit is remote from said transportable container.

70. A transportable item comprising:

15 a forklift carriable pallet;  
sealing means;  
produce, said produce being sealed within said sealing means and on said pallet;

said item having associated therewith means electrically energiseable or otherwise forcing to circulate the gas environment within said transportable container  
20 when said sealing means is substantially sealed;

the temperature of the environment within said container being capable of being effected by heat exchange from said circulating gas environment through at least part of at least one wall of said transportable container;

means to control the temperature within said transportable container such that  
25 said temperature is held or lowered and then held.

71. A transportable item as claimed in claim 70 wherein said means electrically energiseable or otherwise forcing to circulate the gas environment is housed within an upper part of said item when in use.

72. A transportable item as claimed in claim 70 or 71 wherein said means electrically  
30 energiseable or otherwise forcing is a fan preferably variable in speed.

73. A transportable item as claimed in any one of claims 70 to 72 wherein said sealing

-33-

means comprising a plastics bag or similar sheeting.

74. A transportable item as claimed in claim 73 wherein said plastics bag is at least gas semi-permeable with respect to certain gases, for example, ethylene.

75. A transportable item as claimed in any one of claims 70 to 74 wherein said forklift  
5 carriable pallet is of a standard type.

76. A method of transporting or readying for transport, storing or readying for storing as herein described with reference to one or more of the accompanying figures.

77. A transportable container or item as herein described with reference to any one or more the accompanying figures.

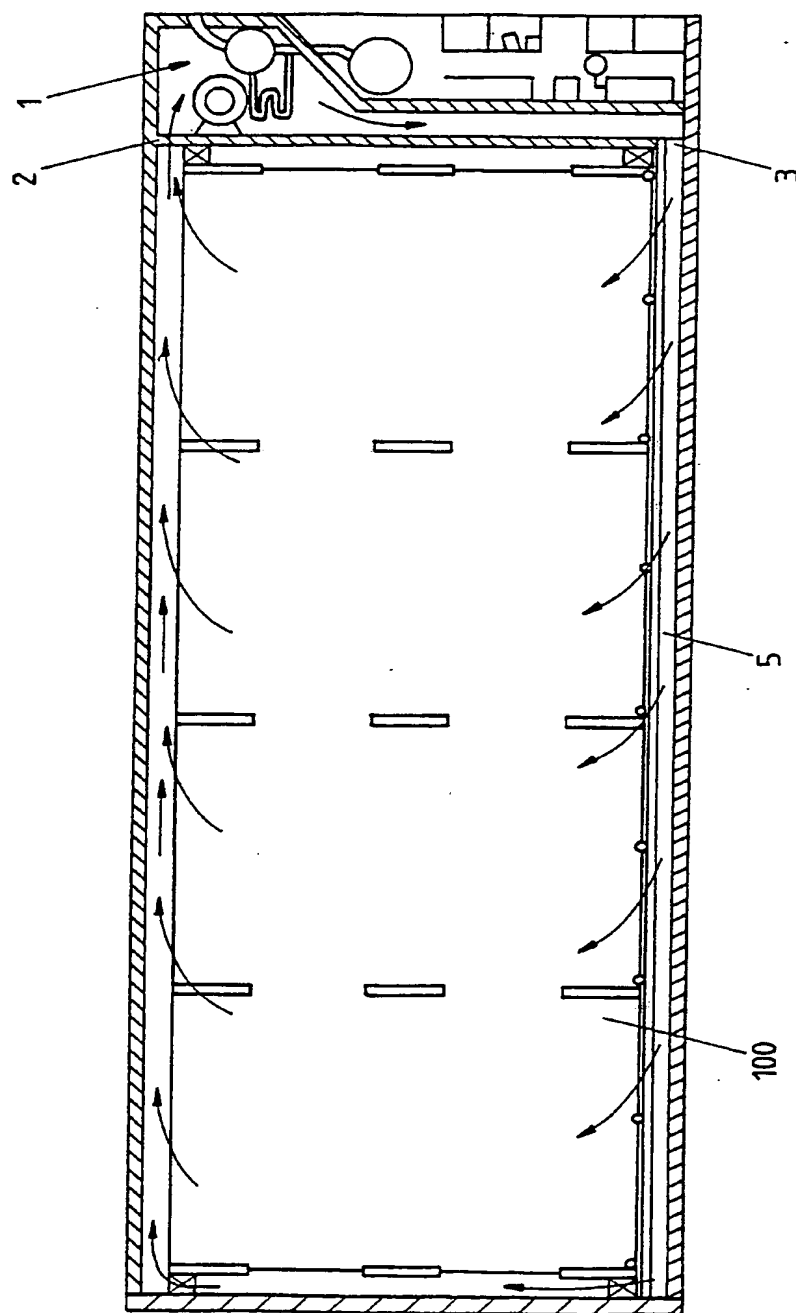
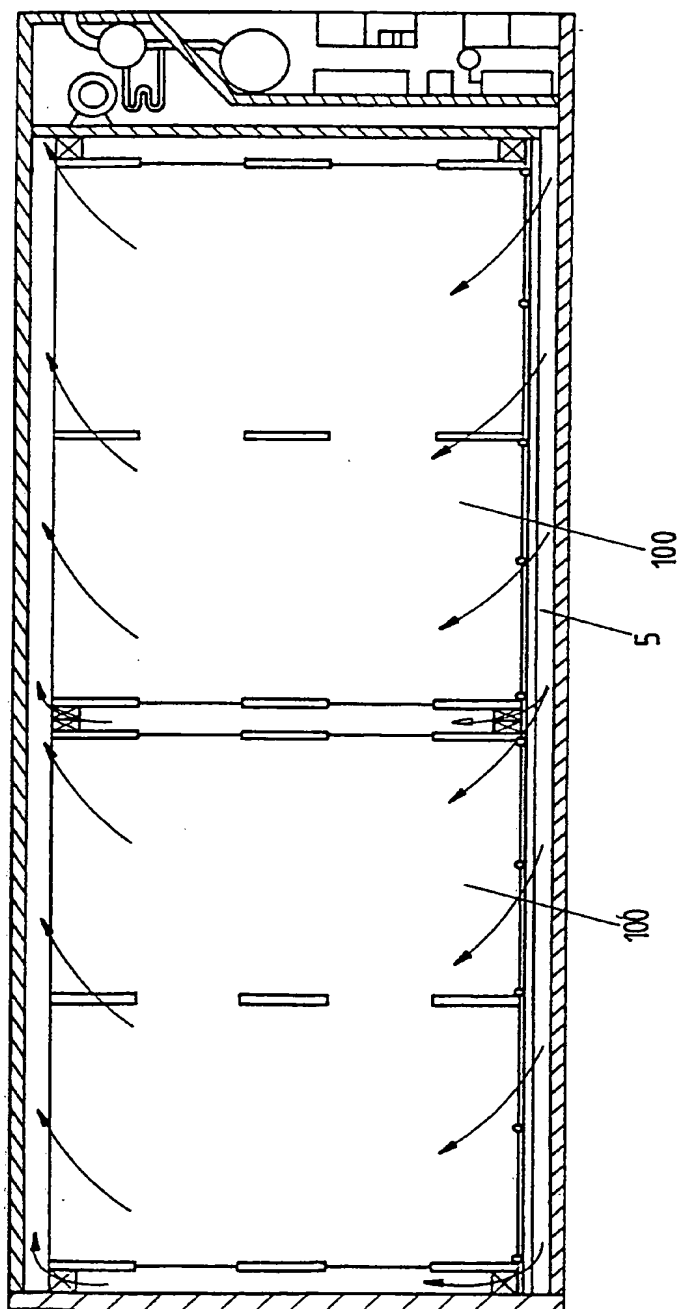


FIG 1

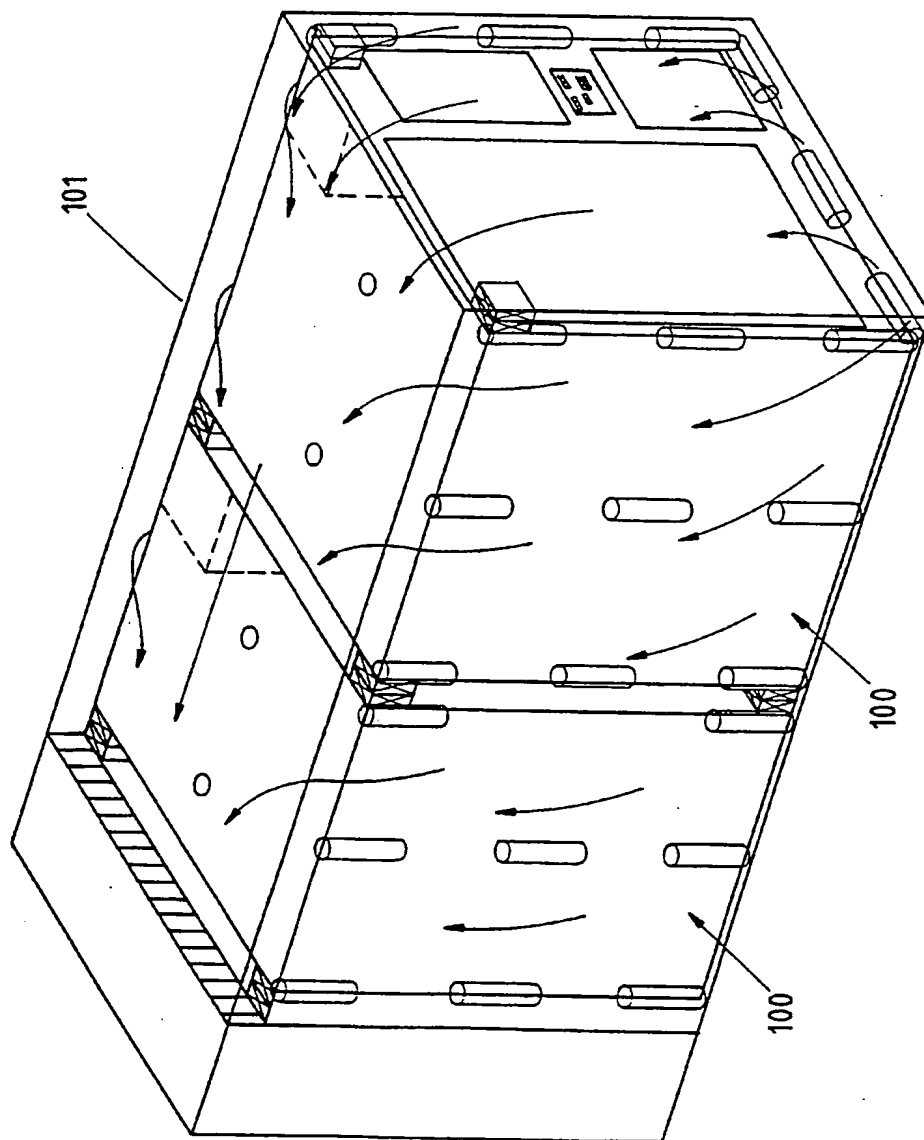
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FIG 2



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**FIG 3**



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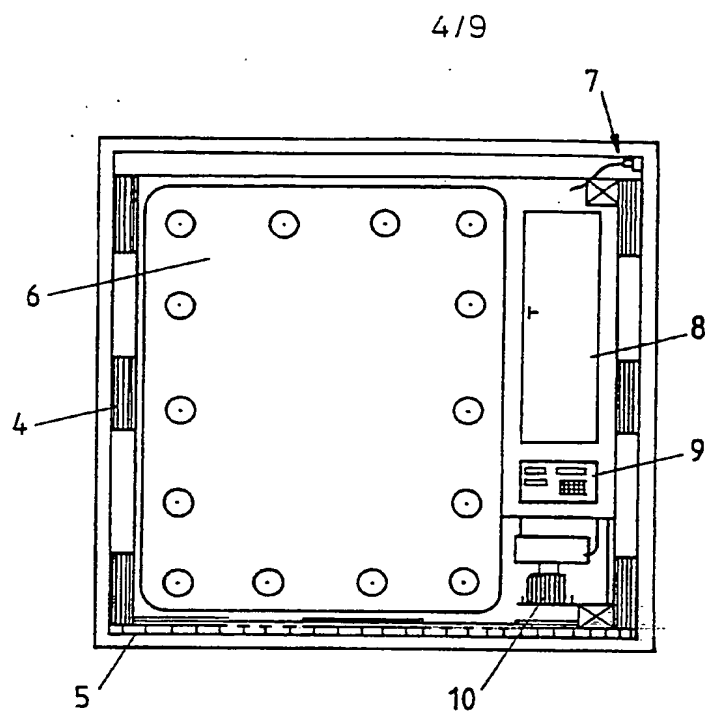


FIG 4

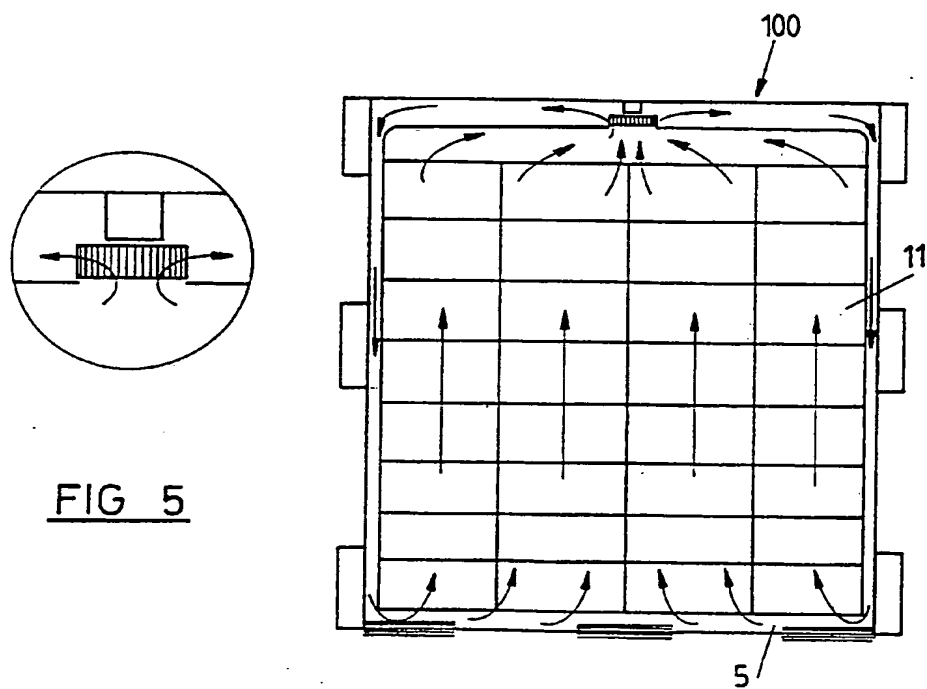
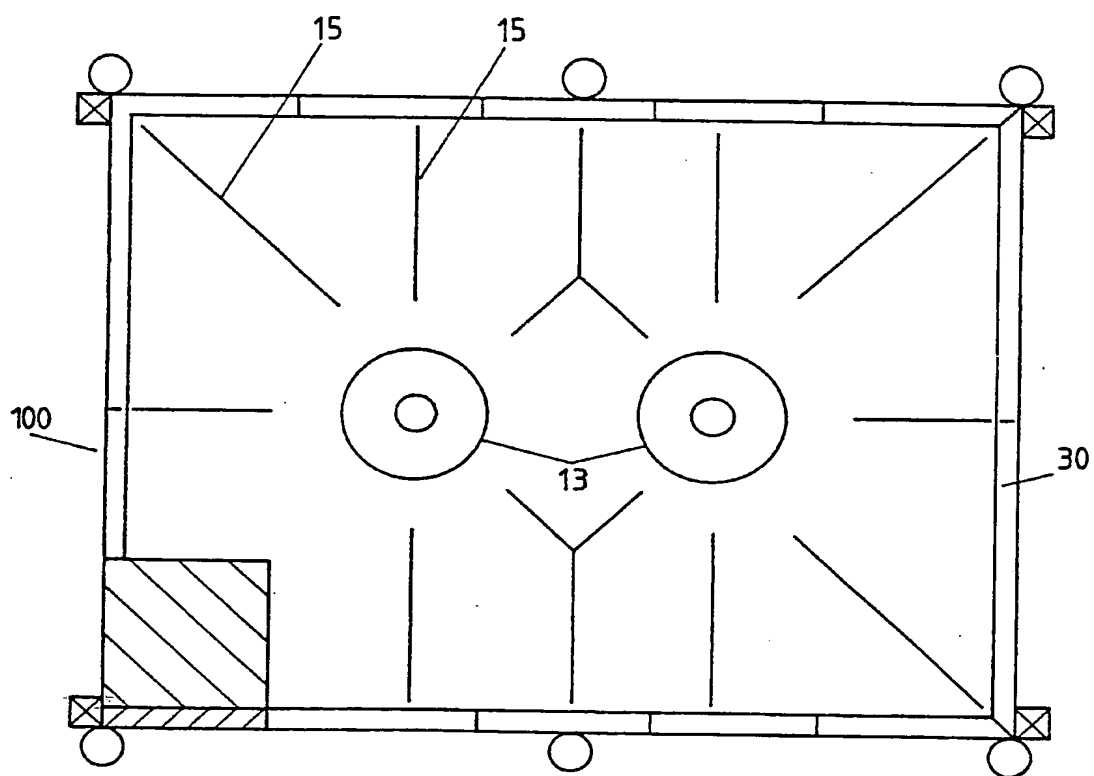


FIG 5

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5/9

FIG 6



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6/9

FIG 7

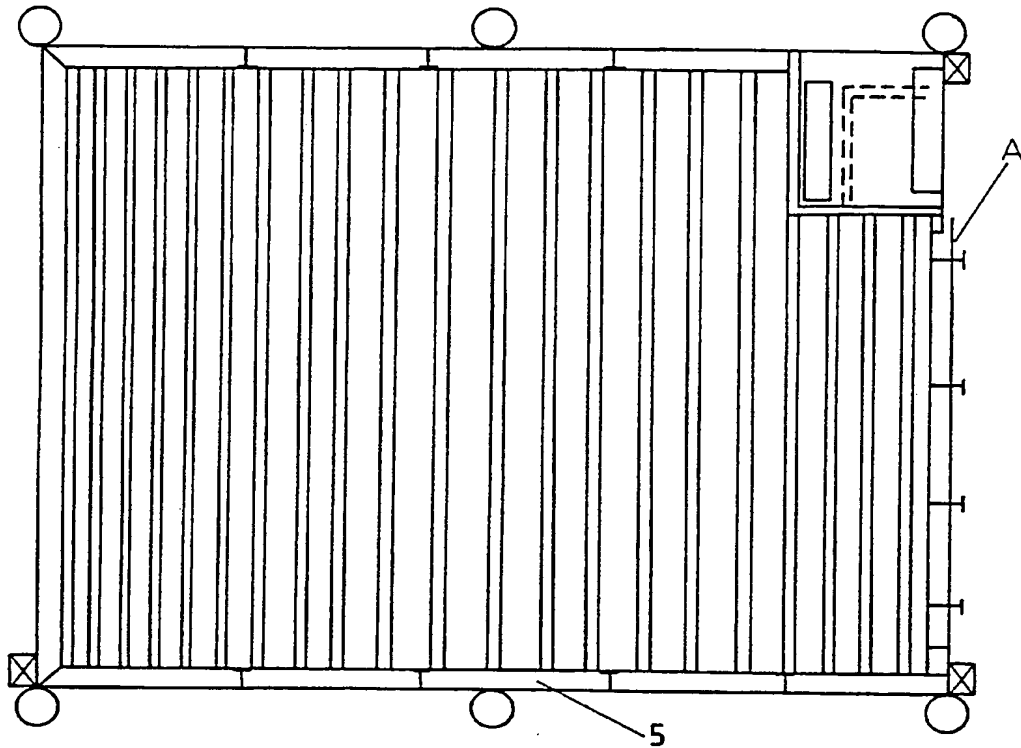
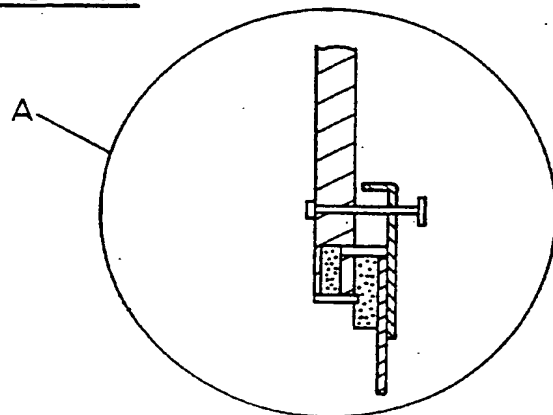
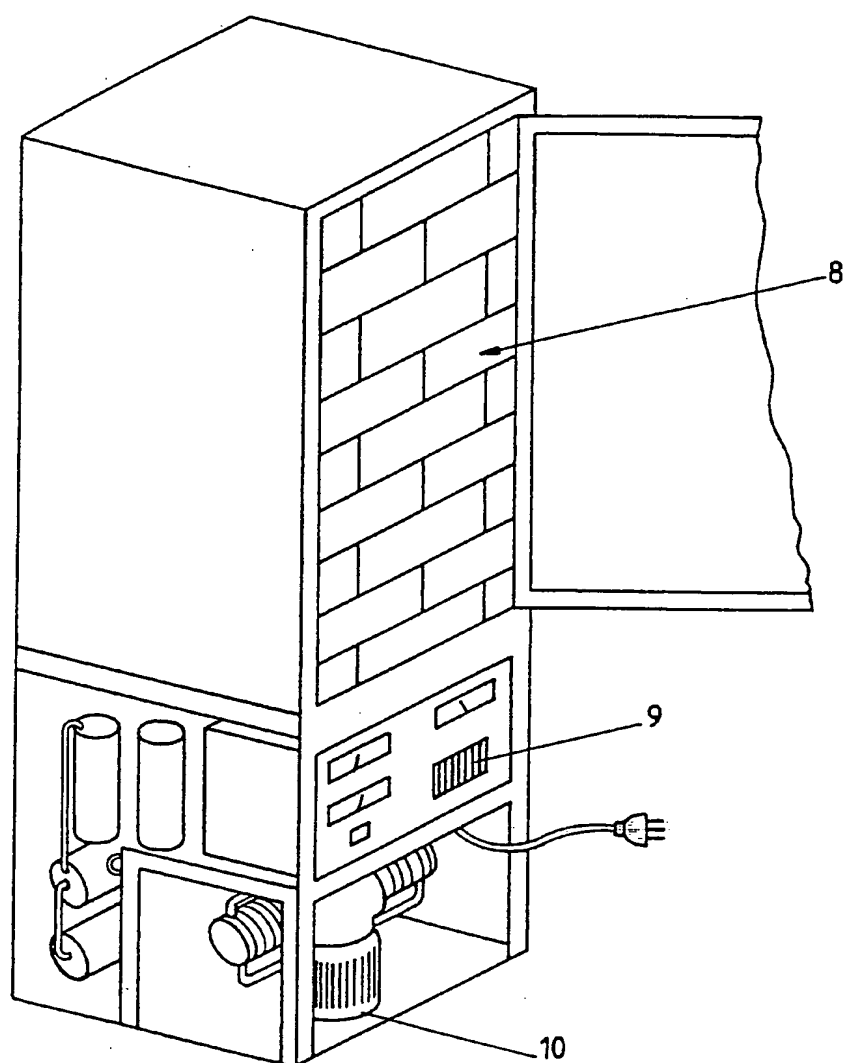


FIG 7A



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FIG 8



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FIG 9

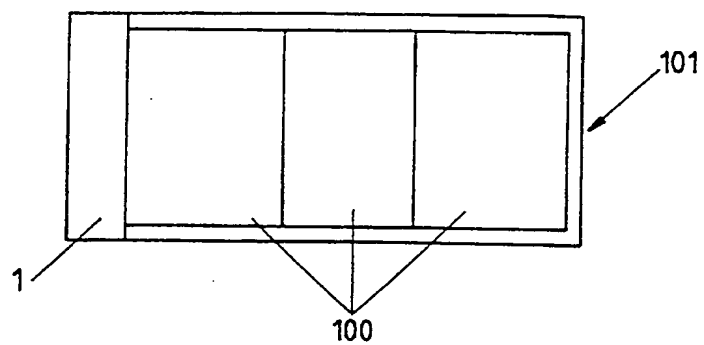


FIG 10

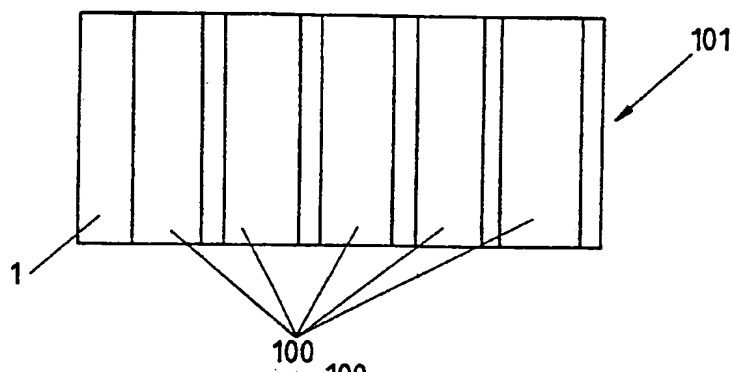
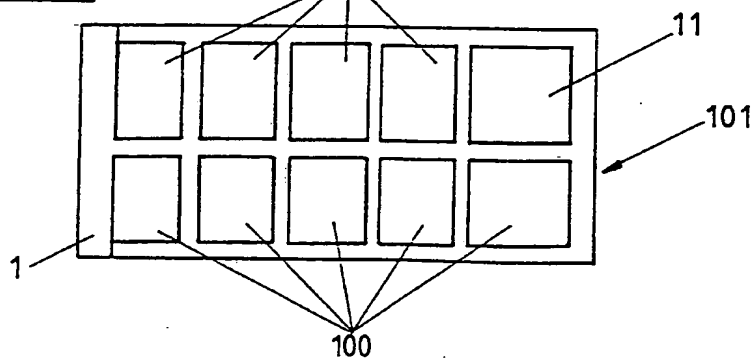
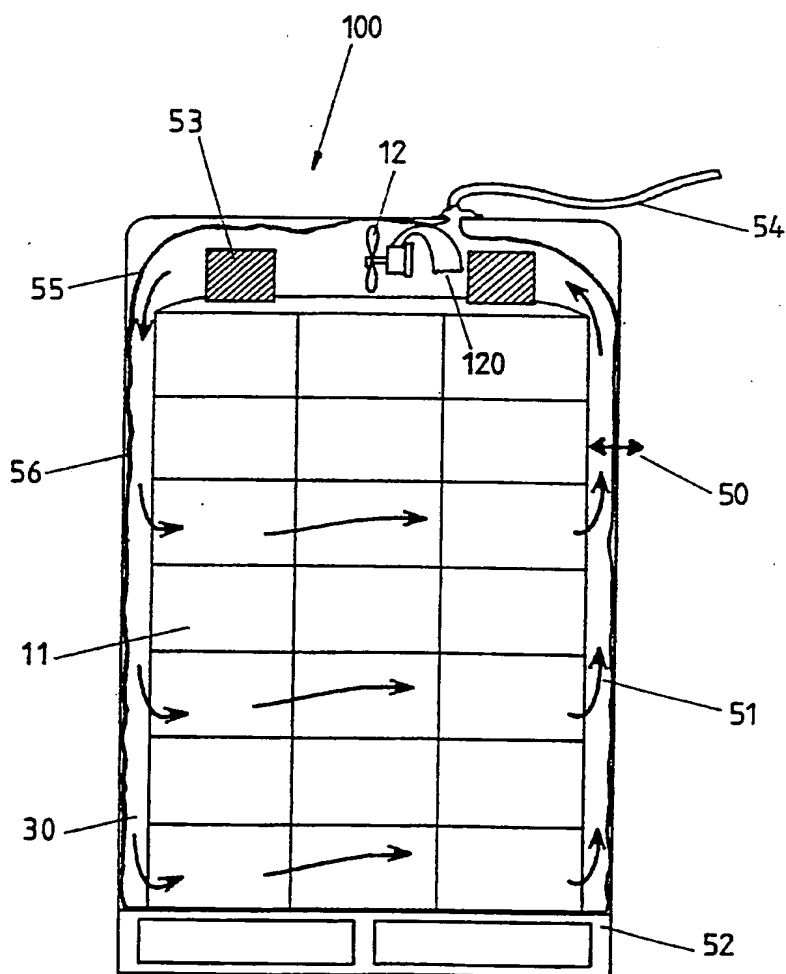


FIG 11



**SUBSTITUTE SHEET**

FIG 12



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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/NZ 95/00017

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> Int. Cl. <sup>6</sup> F25D 11/02; B65D 88/74, 19/38.  According to International Patent Classification (IPC) or to both national classification and IPC																						
<b>B. FIELDS SEARCHED</b>  Minimum documentation searched (classification system followed by classification symbols) IC F25D 11/02, 13/04; B65D 88/74, 81/18  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  Electronic data base consulted during the international search (name of data base, and where practicable, search terms used) DERWENT: F25D 23/ BAG OR SACK B65D 19/ REFRIG: OR HEAT:																						
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>																						
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.																				
X	WO 88/10222 A1 (FURUNO ELECTRIC CO. LTD et al) 29 December 1988	1-6,9-13,26-27,34-38, 51,53,57-58																				
Y		17-23,28-31,42-48, 54-58																				
X	DE 3810655 A1 (HOLZER) 18 January 1990	1,11,																				
Y	DE 4218026 A1 (RADEBOLD) 2 December 1993	17-23,28-31,42-48, 54-56																				
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.																						
* Special categories of cited documents : <table border="0"> <tr> <td>"A"</td> <td>document defining the general state of the art which is not considered to be of particular relevance</td> <td>"T"</td> <td>later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"E"</td> <td>earlier document but published on or after the international filing date</td> <td>"X"</td> <td>document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"L"</td> <td>document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"Y"</td> <td>document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"O"</td> <td>document referring to an oral disclosure, use, exhibition or other means</td> <td>"&amp;"</td> <td>document member of the same patent family</td> </tr> <tr> <td>"P"</td> <td>document published prior to the international filing date but later than the priority date claimed</td> <td></td> <td></td> </tr> </table>			"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"E"	earlier document but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family	"P"	document published prior to the international filing date but later than the priority date claimed		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention																			
"E"	earlier document but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone																			
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art																			
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family																			
"P"	document published prior to the international filing date but later than the priority date claimed																					
Date of the actual completion of the international search 15 May 1995		Date of mailing of the international search report 20 JUNE 1995 (20.06.95)																				
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA  Facsimile No. 06 2853929		Authorized officer  IAN KILBEY  Telephone No. (06) 2832162																				

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/NZ 95/00017

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
P,A	FR 2701095 A1 (SOCIETE INDUSTRIELLE DE FROID ET DE CONDITIONNEMENT) 5 August 1994	
X	PATENT ABSTRACTS OF JAPAN, M 886, page 4, JP 1-189473A (MATSUSHITA REFRIG CO LTD) 28 July 1989	70-72
Y		65
Y	AU 68359/87 (598228)B (MITSUI & CO. LTD & DMI COMPANY LTD) 28 July 1987	65
X	PATENT ABSTRACTS OF JAPAN, C 258, page 31, JP 59-151878A (MATSUSHITA DENKI SANGYO KK) 30 August 1984	70-72

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# INTERNATIONAL SEARCH REPORT

## Information on patent family members

International application No.  
PCT/NZ 95/00017

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
WO	8810222	JP	3085282	JP	3085281		
AU	68359/87	EP	252988	JP	62190068	US	4845958
		WO	8704053	JP	62158972		

END OF ANNEX